BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 20

2006 ANNUAL UPDATE

Shellfish Sanitation Program

Water Monitoring, Assessment and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

July 2006

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

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[Data Thru December 2005]

Shellfish Management Area 20
Shellfish Sanitation Program

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South Carolina Department of Health and Environmental Control

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ANNUAL UPDATE
Shellfish Management Area 20
SCDHEC EQC Bureau of Water

Data Inclusive Dates:
01/01/03 thru 12/31/05

Classification Change:
__Yes _X_ No

Shoreline Survey Completed: _Yes_

Prior Report & Date: Annual -2005

(I)ncreased/(D)ecreased/(N)one:
__N__ Approved
__N__ Conditionally Approved
__N__ Restricted
__N__ Prohibited

SUMMARY

Shellfish water quality for the current three-year review period is statistically similar to water quality data included in the 2005 Annual Update. The bacteriological water quality analysis and shoreline survey indicate that Shellfish Management Area 20 classifications are adequate. No changes to current classification boundaries are recommended.

Stormwater appears to adversely affect shellfish water quality within portions of Area 20. The Town of Hilton Head is continuing to incorporate water quality protection measures in its drainage improvement projects. With increased development, central sewer is replacing septic tanks as the primary method of wastewater treatment and disposal for the majority of new structures in Area 20.

The Conditionally Approved portion of Broad Creek extends from Station 03 to Station 25, excluding all Administratively Prohibited closure zones. Water quality at Broad Creek stations 03, 04A, 15A, 17B, 18, 24, 25, 28 and 29 currently meet statistical criteria for an Approved classification. However, because Broad Creek serves as the major drainage basin/stormwater outlet for Hilton Head Island, water quality can be highly variable. The classification of these stations will therefore remain Conditionally Approved. Management criteria for the Broad Creek Conditionally Approved area will remain at 1.40 inches per 24 hours, as recorded at the Broad Creek PSD wastewater treatment plant. Stations 28 and 29 were created in 2003 and are classified for the first time in this report. These stations will be included in the list of stations used to re-open the Broad Creek Conditionally Approved area following rainfall closures.

The Town of Hilton Head has installed a kiosk at the Marshland Road boat landing on Broad Creek. A harvest classification map of the Broad Creek area, an Open/Closed sign for the Conditionally Approved area, and other shellfish harvesting information is included and updated, as appropriate.

Marina surveys are presently being conducted in Skull Creek to more accurately delineate Prohibited closure zones Broad Creek marinas will be surveyed prior to the 2007 Annual update.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47 that provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The National Shellfish Sanitation Program (NSSP) Guide For The Control Of Molluscan Shellfish is used by the United States Food and Drug Administration (USFDA) to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved - Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations which would render shellfish unsafe for human consumption. The Approved area classification shall be designated based upon a sanitary survey which includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, and not more than ten percent of the samples shall exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, and the estimated ninetieth percentile shall not exceed an MPN of forty three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP Guidelines.

Conditionally Approved - Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution

from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as Conditionally Approved. Where appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

Restricted - Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree which may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Conditionally Restricted - Growing areas may be classified Conditionally Restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as Conditionally Restricted. Where appropriate, the management plan for each Conditionally Restricted area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems and an evaluation of each source of pollution) and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as Conditionally Restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For Conditionally Restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of Conditionally Restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Prohibited - Growing areas are classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities which could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

Shellfish Management Area 20 consists of approximately 22,448 acres of shellfish growing area habitat in Beaufort County, South Carolina. The area is comprised of Calibogue Sound and the Skull, Mackay, Jarvis, Old House, and Broad Creek tributaries. The area's northern boundary originates near the Colleton River, then follows the shoreline of Port Royal Sound, crosses the mouth of Mackay and Skull Creek, and continues to the Atlantic Ocean. The eastern boundary and southern boundaries are defined by the Atlantic Ocean. The western boundary extends northward through the lower portions of Bull Island and May River.

Although the majority of Area 20 is moderately developed, the Hilton Head Island area supports dense development that includes many golf course plantations, shopping malls, restaurants, and marinas. 1995 census data of the island indicates a population of approximately 28,500 permanent residents. During summer months, tourism increases average population to near 70,000. Major holiday periods result in population peaks of approximately 100,000.

The harvesting classifications of Area 20 prior to this survey were as follows:

Prohibited (Administrative closure):

1. Those waters adjacent to Harbor Town Marina and approximately 1000 feet northeast and southeast; approximately 1000 feet adjacent to Moss Creek marina; approximately 1000 feet adjacent to Skull Creek Marina; approximately 1000 feet adjacent to Outdoor Resorts marina; approximately 1000 feet adjacent to Windmill Harbor Marina, approximately 1000 feet adjacent to South Beach marina including area within line from offshore edge of South Beach Marina closure zone to the offshore edge of Harbor Town marina closure zone;
2. Those waters within approximately 1000 feet of the marinas and docking facilities in Broad Creek. These facilities include Palmetto Bay Marina, Shelter Cove Marina, Wexford Harbor, Broad Creek Marina, and the Long Cove community dock.
3. Those waters adjacent to the boat docking facilities at Villages on Skull Creek, Hilton Head Plantation, Baynard Cove, Gull Point community, and Schillings Boat House;
4. Those waters in Broad Creek adjacent to the Sea Pines outfall approximately 1000 feet north and south of the mouth of Lawton Creek;
5. Folly Creek, the entire tributary to its confluence with the Atlantic Ocean.

Restricted / No Depuration: None

Restricted:

1. Broad Creek, from the boundary of the Conditionally Approved area at Station 25, to the headwaters, including Station 16;

2. Fish Haul Creek, from its headwaters to its confluence with Port Royal Sound.

Conditionally Approved:
Broad Creek, from Station 03 to Station 25 (excluding all administratively Prohibited closure zones).

Approved: The remaining waters of Area 20.

The shellfish industry in South Carolina is based mainly on the harvest of the eastern oyster (*Crassostrea virginica)* and hard clams (*Mercenaria mercenaria*).

Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State Shellfish Grounds, Culture Permits, Recreational Shellfish Grounds, and Kings Grants. There are ten Culture Permit (essentially commercial leases) areas in Area 20. Recreational harvesting is allowed for clams and oysters on all State Shellfish Grounds, and commercial harvesting by licensed individuals is allowed, subject to seasons established by SCDNR. State Shellfish Ground 005 is located on Haig Point; 029 is located in Jarvis Creek; and 048 is at the northern end of Hilton Head Island, beginning at the mouth of Skull Creek and extending into Port Royal Sound. Recreational harvesting only is allowed on the Last End Point Recreational Shellfish Ground R-036).

Shellfish harvesting season in South Carolina extends from September 16 through May 15, although actual dates may vary. SCDNR has the authority to alter the shellfish harvest season for management purposes. The South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that all shellfish harvested in South Carolina waters are safe for human consumption.

POLLUTION SOURCE SURVEY

SURVEY PROCEDURES

Shoreline surveys of Area 20 were conducted by the Low Country District Shellfish Sanitation staff**,** by watercraft, vehicle, and on foot, during the survey period and are ongoing.

POINT SOURCE POLLUTION

Major sources of actual or potential pollution (see Figure 4):

PERMITTED FACILITIES	PERMIT #/TYPE/ DISCHARGE
Water Oaks Utilities/ Moss Creek Plantation WWTP	ND0014567-001/ 0.179 MGD/spray irrigation
Hilton Head PSD # 1	SC0046191-001, 002, 003, 004, 005, 006/ 3.2 MGD/ wetlands
Hilton Head PSD# 1	ND0068462-001/ 3.2 MGD/ Spray Ir.

Broad Creek PSD	ND0063100-001/ 2.085 MGD/ Spray Ir.
South Island PSD/ Long Cove WWTP	ND0013528-001/ 0.225 MGD/ Spray Ir.
South Island PSD/ Wexford WWTP	ND0017141-001/ 0.227 MGD/ spray irrigation
South Island PSD / Sea Pines WWTP	ND0064033-001/ 5.0 MGD/ spray irrigation
South Island PSD / Sea Pines WWTP	SC0042501-001, 002, 003 / 5.0 MGD/ 2 wetlands
Skull Creek Marina	Marina- with pumpout facilities
Schillings Boathouse	Dry stack marina- no pumpout
Outdoor Resorts Marina	Marina-with pumpout
Windmill Harbor Marina	Marina- with pumpout
Broad Creek Marina	Marina- no pumpout
Shelter Cove Marina	Marina- with pumpout
Palmetto Bay Marina	Marina- with pumpout
Wexford Lock Harbor	Marina- with pumpout
Harbor Town Marina	Marina- with pumpout
South Beach Marina	Marina- no pumpout

A. Municipal and Community Waste Treatment Facilities - There are no direct discharges of wastewater into Area 20 shellfish growing waters. Treated effluent is typically used for spray irrigation of golf courses and landscape areas. Wetland areas are also used for disposal of treated effluent, particularly during periods when the golf courses are too wet to use the water. Although most structures on Hilton Head Island are serviced by central sewer, some homes still utilize septic tanks for wastewater treatment and disposal. Many of the homes adjacent to the northern shore of Broad Creek use septic tanks. South Island PSD reports that in the last five years they have provided sewer to 560 lots in Sea Pines Plantation previously utilizing septic tanks.

Hilton Head Public Service District reports they have provided sewer to 22 vacant parcels of land (with the potential for up to 90 homes), as well as approximately 48 homes currently utilizing septic tanks in the Muddy Creek Road area. Sewer will be available to approximately 70 lots and/or existing homes in the Folly Field subdivision. A contract has recently been awarded to provide sewer to 60 lots and/or existing homes in the Holiday Homes subdivision.

B. Industrial wastes -There are no permitted industrial discharges in Area 20.

C. Marinas - S.C. Regulation 61-47, Shellfish defines Marina as "any water area with a structure (docks, basin, floating docks, etc.) that is: 1) used for docking or otherwise mooring vessels; and, 2) constructed to provide temporary or permanent docking space for more than ten boats, or has more than 200 linear feet of docking space." There are ten marinas in Area 20 (see Figure 4). Facilities along Skull Creek are in the process of being evaluated to determine specific closure zone sizing. The United States Environmental Protection Agency Region IV, pursuant to Section 312(f) (3) of the Clean Water Act and Federal Regulation 40 CFR 140.4, has approved the designation of Broad Creek as a No Discharge Zone (NDZ).

D. Radionuclides - The Savannah River is a potential source of Radionuclides in Area 20. A fish-consumption advisory is in effect for Strontium-90 and Cesium-137 in the Savannah River from Beech Island, in Aiken County, to the Webb Wildlife Center in Hampton County. Radionuclide monitoring of oyster tissue conducted in 1998 and 1999 showed levels for Cesium and Strontium at below detection levels.

NONPOINT SOURCE POLLUTION

A. Stormwater - Hilton Head Island is a coastal barrier island of approximately 22,000 acres. Over the last 40 years, about 16,525 acres have been developed into 11 planned communities and 21 golf courses. The highest point on the island is 28 feet above mean sea level (m.s.l.) with the average being approximately 14 feet above m.s.l. Flooding and stormwater drainage have become critical issues on the island due to the low elevations and relatively flat topography.

Within the planned communities on the island, the stormwater drainage systems typically consist of an arrangement of inter-connecting ditches and lagoons. The majority of the island's stormwater is directed to Broad Creek. Broad Creek receives stormwater from five major drainage systems. They are: the Port Royal Plantation system, Palmetto Dunes, Wexford/Shipyard Plantation, Sea Pines/Lawton canal, and Indigo Plantation. Sampling conducted during the Broad Creek Nonpoint Source Assessment study done in 1995/96 confirmed the presence of high levels of fecal coliforms associated with the low salinity waters of the drainage systems.

In the summer of 1996, The Town of Hilton Head was awarded a Section 319 mini-grant to study nonpoint source pollution in Broad Creek. The study found that correlations of fecal coliform concentrations with salinity and rainfall indicate that the contamination occurs in stormwater runoff rather than from other sources such as sewage discharged from marinas. The report identified two primary NPS pollution inputs to Broad Creek as the headwaters region and Lawton Creek.

Construction of stormwater system improvements on the Ashmore Tract project has been completed. This area consists of wetlands and forest and has drainage ditches that discharge into the headwaters of Broad Creek at Matthews Drive. The work completed includes excavating the ditch channel to its original depth, and installing V-notch weirs to increase detention time of water in the ditch. The tributary ditches behind Hilton Head PSD and near the Santee Cooper power station have been blocked with check dams to

increase sheet flow (across the wetland area), percolation, and evaporation. In addition, a bio-retention pond near the fire station has been created to create a natural filter for the stormwater.

The Jarvis Creek Park opened to the public on May 5, 2003. Stormwater from the Main Street and Hilton Head Plantation areas will be pumped up into the 11-acre lake where sediment will settle out. The water then flows through a man-made wetland, which absorbs substances such as nitrogen and phosphorus, before reaching Jarvis Creek.

The (former) Captain's Seafood site on Matthews Drive has been acquired by the Town of Hilton Head. A wetlands mitigation site is planned to treat stormwater from Matthews Drive prior to discharge to Broad Creek.

Construction on the North Forest Beach project has been completed. This project included installing a stormwater collection system in North Forest Beach and maintenance on existing ditches, which transport stormwater through Shipyard Plantation, under Highway 278 to Wexford Plantation and eventually to Broad Creek. Stormwater pumps were installed in Shipyard Plantation and at the discharge point to Broad Creek.

The Beach City Road/Airport drainage project consists of constructing a stormwater detention pond along an existing 8-foot wide outfall channel. This will provide regional detention for the Palmetto Headlands commercial area.

The Northridge drainage project is under construction. This project includes installation and remediation of closed conduit and open channel drainage infrastructure in the Tabby Walk / Matthews Drive area and in Indigo Plantation.

Stormwater runoff impacts water quality by transporting fecal coliform bacteria (and other pollutants) from land to the shellfish growing area. Stormwater from roads, residences, and agricultural land is directed to the lowest point of elevation which is typically the nearest creek or marsh. In addition, there are freshwater wetland areas, ditches, and impoundments that drain into tidal creeks.

Most land disturbing activities in South Carolina must comply with the Stormwater Management and Sediment Reduction Act of 1991. The final regulations, effective on June 26, 1992, establish the procedures and minimum standards for a statewide stormwater management program. For activities in the eight coastal counties, additional water quality requirements are imposed. For all projects, regardless of size, which are located within one-half mile of a receiving water body in the coastal zone, the criteria for permanent water quality ponds having a permanent pool is that they are designed to store the first inch of runoff from the entire site over a 24 -hour period or storage of the first one inch of runoff from the built-upon portion of the property, whichever is greater. Storage may be accomplished through retention, detention, or infiltration systems, as appropriate for the specific site. In addition, for those projects that are located within 1000 feet of shellfish beds, the first one and one half inches of runoff from the built-upon portion of the property must be retained on site. Since 1992, these regulations have been applied to the development of residential subdivisions, golf courses, and business areas.

B. **Agricultural Waste -** There are no large-scale commercial agriculture operations, i.e., herds of cattle or farming activities in Area 20.

C. **Individual Sewage Treatment and Disposal (ISTD) Systems - T**he majority of Hilton Head Island is served by sewer, though some homes still utilize septic tanks for wastewater treatment and disposal. Many of the homes adjacent to the northern shore of Broad Creek use septic tanks.

D. **Wildlife and Domestic Animals -** This area supports populations of white-tailed deer, raccoons, wading birds, migratory waterfowl, and other wildlife which may contribute to fecal coliform levels in some areas. Domestic animals present in the area include dogs, cats, horses, and goats. A waste management plan has been developed for Lawton Stables at Sea Pines Plantation. Implementation of the plan was to be completed by September, 1999.

E. **Boat Traffic -** Calibogue Sound provides access to the Atlantic Ocean for commercial and recreational vessels. The Atlantic Intracoastal Waterway (AIWW) runs through Skull Creek and Calibogue Sound to the Cooper River and, eventually, to the Savannah River. Tugs and barges, commercial and recreational vessels utilize this North/South route.

F. **Hydrographic and Habitat Modification -** Hydrographic and habitat modification in estuarine areas requires both State and Federal approval.

G. **Marine Biotoxins -** There have been no documented occurrences of toxic algae affecting water quality in Area 20. The Department participates in a State Task Force on Toxic Algae and maintains a toxic algae emergency response team.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

PHYSIOGRAPHY

A tidal node just northeast of May River separates the Broad River estuary and the Savannah River estuary. Skull and Mackey Creeks and their tributaries are part of the Broad River estuary. The Broad River estuary is a drowned river valley system and the largest of Sea Island Coastal Region estuaries (219 square kilometers). This estuary, which includes Broad River, Beaufort River, Port Royal Sound, and several tidal tributaries, includes an extensive system of marshes, tidal creeks, and sea islands.

The majority of Area 20 is part of the Savannah River estuary, a coastal plain system that includes the New, Wright, and Savannah Rivers and several tributaries of Savannah River (e.g., Front, Back, and Middle Rivers and the South Channel).

The average depth of the estuary is approximately 5 meters at mid-tide level. Navigational channels in the lower Savannah and Front Rivers, downstream from Highway 17, range from 9m to 12m in depth and facilitate the intrusion of saltwater into the estuary. The conversion of

thousands of acres of saltwater wetlands into diked disposal areas on the South Carolina side could also have altered flow patterns and salinity regimes.

Most tidal exchange occurs through the entrance to Savannah River, primarily through the North Channel; however, limited exchange occurs with the Broad River estuary through Calibogue Sound. The salinity structure is primarily determined by controlled releases of freshwater from impoundments on Savannah River and its tributaries. (NOAA, 1994).

Tides - Tides in Area 20 are semidiurnal, consisting of two low and high tides each lunar day. Mean tidal range is 7.0 feet during normal tides and 8.9 feet above mean low water during spring tides.

The greatest tidal ranges of the year typically occur around full moon during the months of September through December. There is considerable variation in the normal tide range due to the prevailing strength and direction of winds.

Rainfall - Rainfall data for the period subsequent to February 1998 has been collected at the Broad Creek PSD wastewater treatment plant. Rainfall data prior to that date was collected at weather station 384169 located at Hilton Head Island. This station has discontinued operations.

Approximately 40% of the annual rainfall falls in the three-month period from June to August. Weather patterns during this time period are often characterized by thunderstorms and shower activity of a short duration. In addition, these three months also have the highest numbers of days with rainfall greater than one inch.

The months of December through March historically have the greatest number of days with rainfall exceeding 0.10" and 0.50". Rainfall events during these months are typically of a longer duration.

Annual rainfall recorded at the Broad Creek PSD weather station was significantly below the 30-year normal amount for 2000 and 2001. Below normal rainfall continued through May 2002 and by August 2002, the drought status of all 46 counties in the state, including Beaufort and Colleton, had been upgraded to extreme. Above normal rainfall beginning in late August, however, led the S.C. Drought Response Committee to downgrade the drought status statewide and remove the drought declaration for Beaufort, Charleston, and Colleton counties on November 21, 2002.

Winds - The prevailing wind direction between February and September ranges between South and South Southwest (180 to 200 degrees) and between October and January is North Northeast (20 degrees). The annual mean wind speed is 8.5 MPH, with August having the lowest (7.3 MPH) and March the highest (10.0 MPH) mean wind speed.

River discharges - There are no freshwater rivers that discharge directly into Area 20. The area is part of the Savannah River estuary, whose salinity structure is primarily determined by controlled releases of freshwater from impoundments on Savannah River and its tributaries. The New River receives freshwater input from the Great Swamp. The Wright River receives most of its freshwater input from Savannah River via Fields Cut (AIWW). Highest river discharge usually

occurs in late winter and early spring due to heavy precipitation in the Blue Ridge and Piedmont areas; lowest discharge occurs during late summer and fall.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 20 in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays, and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July 1998, an updated data analysis procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station yet provides a six-sample "cushion" (above the NSSP required 30 minimum) for broken samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

Nine-hundred and eighty-six (986) surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses at 26 active water quality sampling stations in Area 20 during the period 01/01/03 through 12/31/05. Of this total, nine hundred and thirty-three (933) samples were collected for classification purposes in accordance with the Department's systematic random sampling plan. Two new stations, 28 and 29, were created in Broad Creek at the Northern and Southern boundaries, respectively, of the closure zone were added in the 2003 Annual update. Each station now has (36) sample results for the review period and will be classified for the first time this year.

The samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported by bus to the South Carolina Department of Health and Environmental Control's Trident District Environmental Quality Control laboratory at North Charleston, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding time or contained a temperature control > 10 degrees C. were discarded. Samples collected after September 1, 1986 have been analyzed using the five tube/three dilution modified A-1 method described by Nuefeld (1985).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined Nautical Software's Tides and Currents, Version 2 (1996).

The report, *A Baseline Assessment of Environmental and Biological Conditions in Broad Creek and the Okatie River, Beaufort County, South Carolina* was published in the spring of 2000. The study, conducted by SCDHEC, SCDNR, and the NOAA National Ocean Service, involved a comprehensive assessment of overall water quality, sediment quality, and biological conditions of the two study areas. The report states that system wide, fecal coliform bacteria concentrations were higher in Broad Creek than in the Okatie River. Biotyping of the fecal coliform samples that had *E. coli* indicated that Broad Creek had both a higher incidence of *E. coli* in the in the samples and a higher percentage of antibiotic resistant strains that were indicative of human sources than the Okatie River. There was also a clear association of areas with high *E.coli* counts related to human sources and obvious pollution sources (land application of treated wastewater and septic tanks) in Broad Creek. However, the majority of stations in both Broad Creek (53.3%) and the Okatie River (80%) were negative for the antibiotic resistance tests used for typing probable sources. This suggests that animal wastes are a major contributor of the fecal coliform levels observed in both systems. (SCDHEC, 2000)

In 1999, Beaufort County was investigating the use of a Special Area Management Plan (SAMP) program to address water quality concerns throughout the county. The Town of Hilton Head Island received a grant for research on Broad Creek and became part of the Beaufort County SAMP. The Town developed a Broad Creek Management Plan, which was published in January 2002.

A water quality monitoring program was initiated in 1999, consisting of bi-weekly sampling at six designated stormwater discharge sites on Broad Creek. The following water quality parameters were sampled: temperature, pH, dissolved oxygen, turbidity, nitrate, fecal coliform bacteria, salinity, ammonia, total nitrogen, and total phosphorus. In addition, tide stage was recorded for each sampling event. All water quality monitoring results discussed in the management plan were collected between September 30, 1999 and April 24, 2001. A total of 41 samples were collected and analyzed. None of the stormwater discharge sites on Broad Creek meet the Approved criteria for shellfish harvesting waters. Four of the six sites did meet the standards for primary and secondary contact recreation, crabbing and fishing.

The Town of Hilton Head Island is continuing to monitor 16 land-based water quality sites.

MONITORING RESULTS

Water quality at stations 01, 02, 03, 04A, 05, 06, 07, 09, 10, 11, 12, 13, 15A, 17B, 18, 19A, 20A, 22, 23, 24, 25, 26, 28 and 29 meet statistical criteria for the Approved classification.

Water quality at Station 27 exceeds a fecal coliform MPN geometric mean value of 14. Water quality at stations 16 and 27 exceeds a fecal coliform MPN estimated 90th percentile value of 43. Additionally, water quality at Station 27 exceeds a fecal coliform MPN estimated 90th percentile value of 260.

CONCLUSIONS

Based on review of fecal coliform bacteriological data and the pollution source survey,

Area 20 is impacted by three sources of actual or potential pollution.

NONPOINT SOURCE RUNOFF

Stormwater runoff appears to be the major source of fecal coliform bacteria contamination in Area 20. Stormwater runoff from roads or parking lots discharges directly into the creeks or marsh or enters stormwater lagoons that are usually inter-connected and eventually discharge to a creek. Possible sources of fecal coliform bacteria contamination include pets, wildlife, domestic animals such as horses and cows, failing septic systems, and drainage from roads and freshwater wetlands.

INDIVIDUAL SEWAGE TREATMENT AND DISPOSAL SYSTEMS

The SCDHEC Environmental Health GIS mapping study identified homes with malfunctioning or questionable Individual Sewage Treatment and Disposal Systems (ISTDS), which may impact waters of Area 20.

The report, *A Baseline Assessment of Environmental and Biological Conditions in Broad Creek and the Okatie River, Beaufort County, South Carolina* states that there was a clear association of areas with high *E.coli* counts related to human sources and obvious pollution sources (land application of treated wastewater and septic tanks) in Broad Creek.

BOATING IMPACTS

A large number of vessels utilizing the Atlantic Intracoastal Waterway (AIWW) pass through Area 20. Numerous commercial and recreational marinas are located with Area 20. Sewage pump-out facilities are located at many of these facilities but a potential for discharge of untreated or partially treated sewage exists. The USEPA designation of a No Discharge Zone along with increased public awareness may mitigate impacts within Broad Creek. Boat wakes also may cause re-suspension of fecal coliform bacteria in sediments.

RECOMMENDATIONS

The shoreline survey and bacteriological data review of shellfish Management Area 20 indicates that no changes in classification boundaries are warranted

Water quality at stations 03, 04A, 15A, 17B, 18, 24, 25, 28, and 29 in Broad Creek currently meets the statistical criteria for Approved classification. However, due to potential water quality variability along with the knowledge that stormwater runoff can have an adverse impact on water quality and public health, the harvest classification of these stations is recommended to remain Conditionally Approved. The Conditionally Approved area is recommended to extend upstream from Stations 03 to Station 25, excluding all administratively Prohibited closure zones. Management criteria for the Broad Creek Conditionally Approved area is recommended to remain at 1.40 inches per 24 hours, as recorded at the Broad Creek PSD wastewater treatment plant. Stations 28 and 29 were added to the Broad Creek Conditional Area in 2003 and were classified for the first time in this report. The two new stations will be assessed and

used to manage the area on rainfall along with the remaining conditional area samples.

Station 16 exceeded a fecal coliform MPN geometric mean value of 14 and a fecal coliform MPN estimated 90th percentile of 43, thereby meeting the statistical criteria for a Restricted classification. Therefore, Broad Creek, from Station 25 to the headwaters (including Station 16), is recommended to retain a Restricted classification.

Station 27 exceeded a fecal coliform MPN geometric mean value of 14 and a fecal coliform MPN estimated 90th percentile of 43, thereby meeting the statistical criteria for a Restricted classification. Therefore, Fish Haul Creek, from its headwaters to its confluence with Port Royal Sound, is recommended to retain a Restricted classification.

Relaying and container relaying of shellfish from Restricted areas to Approved areas, and depuration are other options available for harvest of shellfish within Restricted areas in Area 20.

Marinas in Broad Creek having approximate 1000 ft. closures should be surveyed prior to the 2007 Annual update.

The following growing waters classification of Area 20 is recommended (see Figure 3):

Prohibited (Administrative closure):

1. Those waters adjacent to Harbor Town Marina and approximately 1000 feet northeast and southeast; approximately 1000 feet adjacent to Moss Creek marina; approximately 1000 feet adjacent to Skull Creek Marina; approximately 1000 feet adjacent to Outdoor Resorts marina; approximately 1000 feet adjacent to Windmill Harbor Marina, approximately 1000 feet adjacent to South Beach marina including area within line from offshore edge of South Beach Marina closure zone to the offshore edge of Harbor Town marina closure zone;
2. Those waters within approximately 1000 feet of the marinas and docking facilities in Broad Creek. These facilities include Palmetto Bay Marina, Shelter Cove Marina, Wexford Harbor, Broad Creek Marina, and the Long Cove community dock.
3. Those waters adjacent to the boat docking facilities at Villages on Skull Creek, Hilton Head Plantation, Baynard Cove, Gull Point community, and Schillings Boat House;
4. Those waters in Broad Creek adjacent to the Sea Pines WWTP outfall approximately 1000 feet north and south of the mouth of Lawton Creek;
5. Folly Creek, the entire tributary to its confluence with the Atlantic Ocean.

Restricted / No Depuration: None

Restricted:

1. Broad Creek, from the boundary of the Conditionally Approved area at Station 25, to the headwaters, including Station 16;
2. Fish Haul Creek, from its headwaters to its confluence with Port Royal Sound.

Conditionally Approved:

Broad Creek, from Station 03 to Station 25 (excluding all administratively Prohibited closure zones).

Approved: The remaining waters of Area 20.

Station Addition/Deactivation/Modification: None

Analysis of sampling data for Area 20 demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of Area 20 will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured at Broad Creek PSD WWTP. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). PMP estimates for the coastal United States have been published in a series of hydro-meteorological reports (HMRs) by the National Weather Service (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*).

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TABLE #1
Shellfish Management Area 20
WATER QUALITY SAMPLING STATIONS DESCRIPTION

Station	Description
01	Braddock Point- South end of Hilton Head Island
02	Calibogue Sound, Marker 32
03	Shark Bank and Broad Creek, Marker 2
04A	Broad Creek at Palmetto Bay Marina CSZ
05	May River at Calibogue Sound
06	Jarvis Creek at Calibogue Sound
07	Buckingham Landing at bridge
09	Mackey Creek and Chechessee River
10	Skull Creek at small creek from Mariner's Cove
11	Skull Creek, Marker 19
12	Skull Creek behind Hilton Head Seafood Company
13	Skull Creek and Port Royal Sound
15A	Broad Creek at Calibogue Sound- North end of Buck Island
16	Creek behind Lynn Smith's Oyster Plant at Broad Creek
17B	Broad Creek at Broad Creek Marina CZ
18	Shelter Cove Marina
19A	Broad Creek at Harbour Town Marina CZ
20A	Moss Creek Marina CZ
22	Old House Creek at Calibogue Sound
23	Jarvis Creek at first major ‘T’
24	Broad Creek at 1st major creek upstream of Station 18
25	Broad Creek at confluence of channel leading to Old Oyster Factory
26	Northwest of South Beach Marina closure zone
27	Fish Haul Creek at Port Royal Sound
28	Broad Creek at Southern boundary of South Island WWTP Prohibited closure zone
29	Broad Creek at Northern boundary of South Island WWTP Prohibited closure zone

(Total Active For Current Report - 26)

Figure 1.
Shellfish Management Area 20 Prior Classification

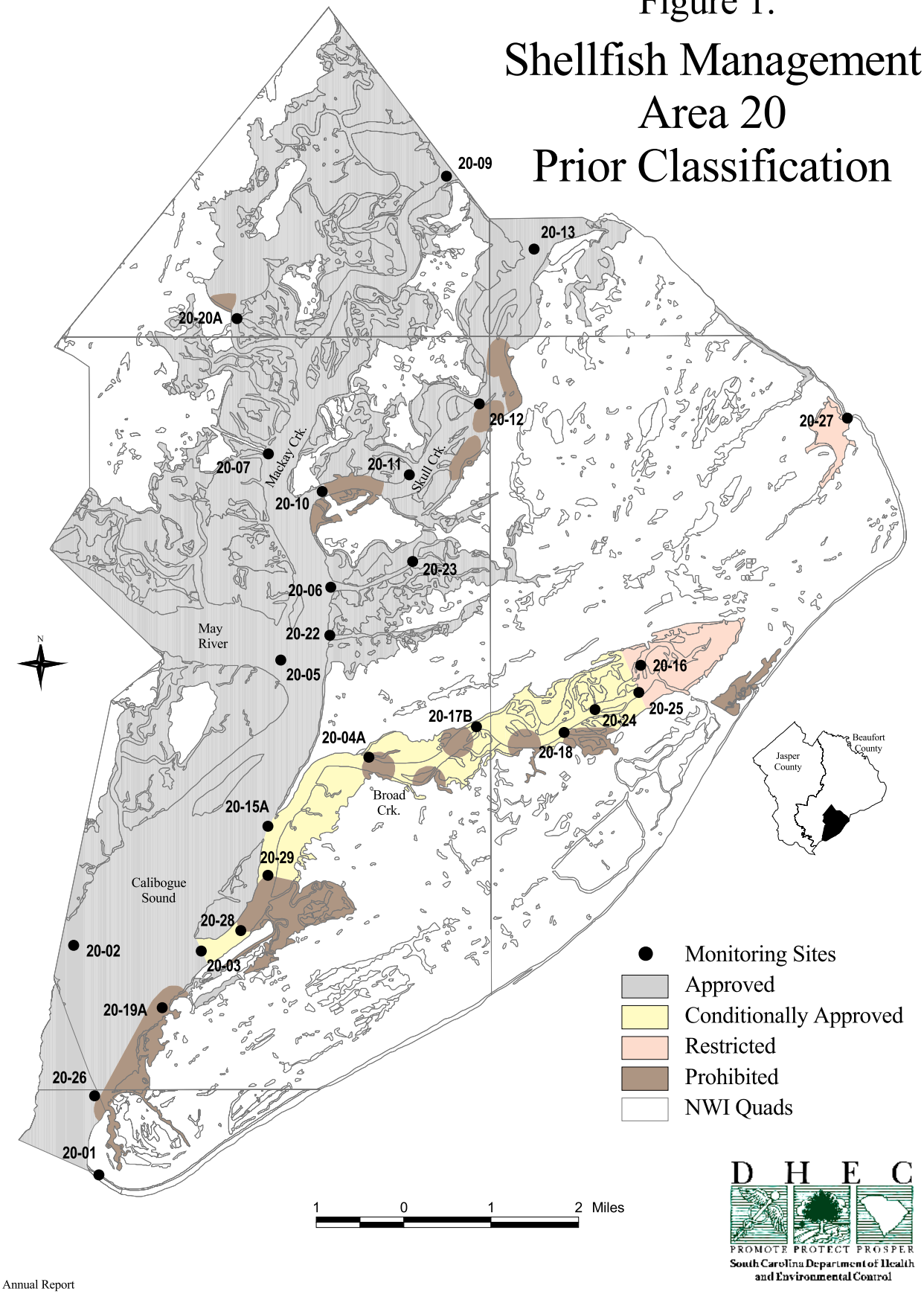

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Figure 2.
Shellfish Management Area 20 Current Classification

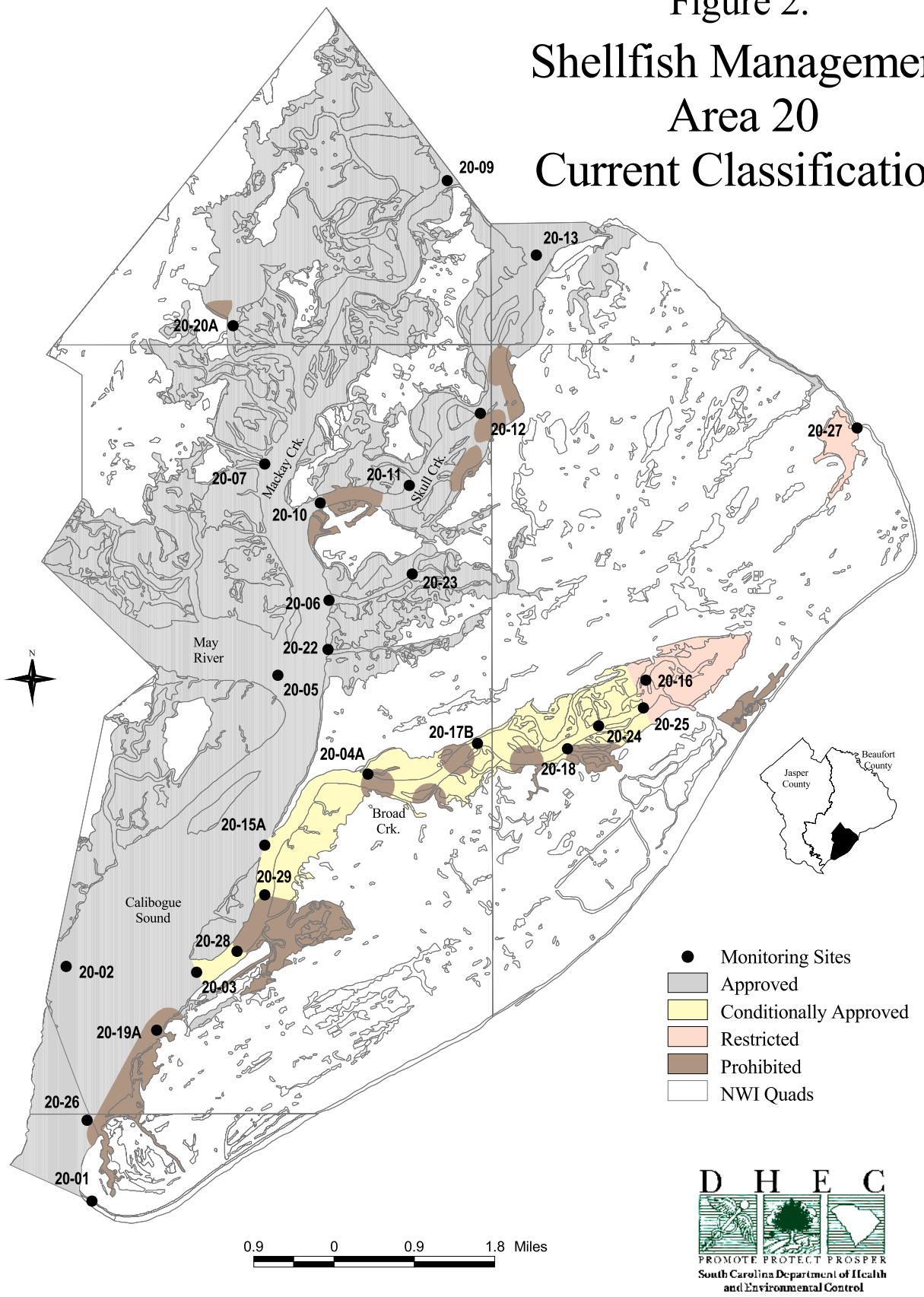

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Figure 3.

Shellfish Management Area 20

Potential Pollution Sources

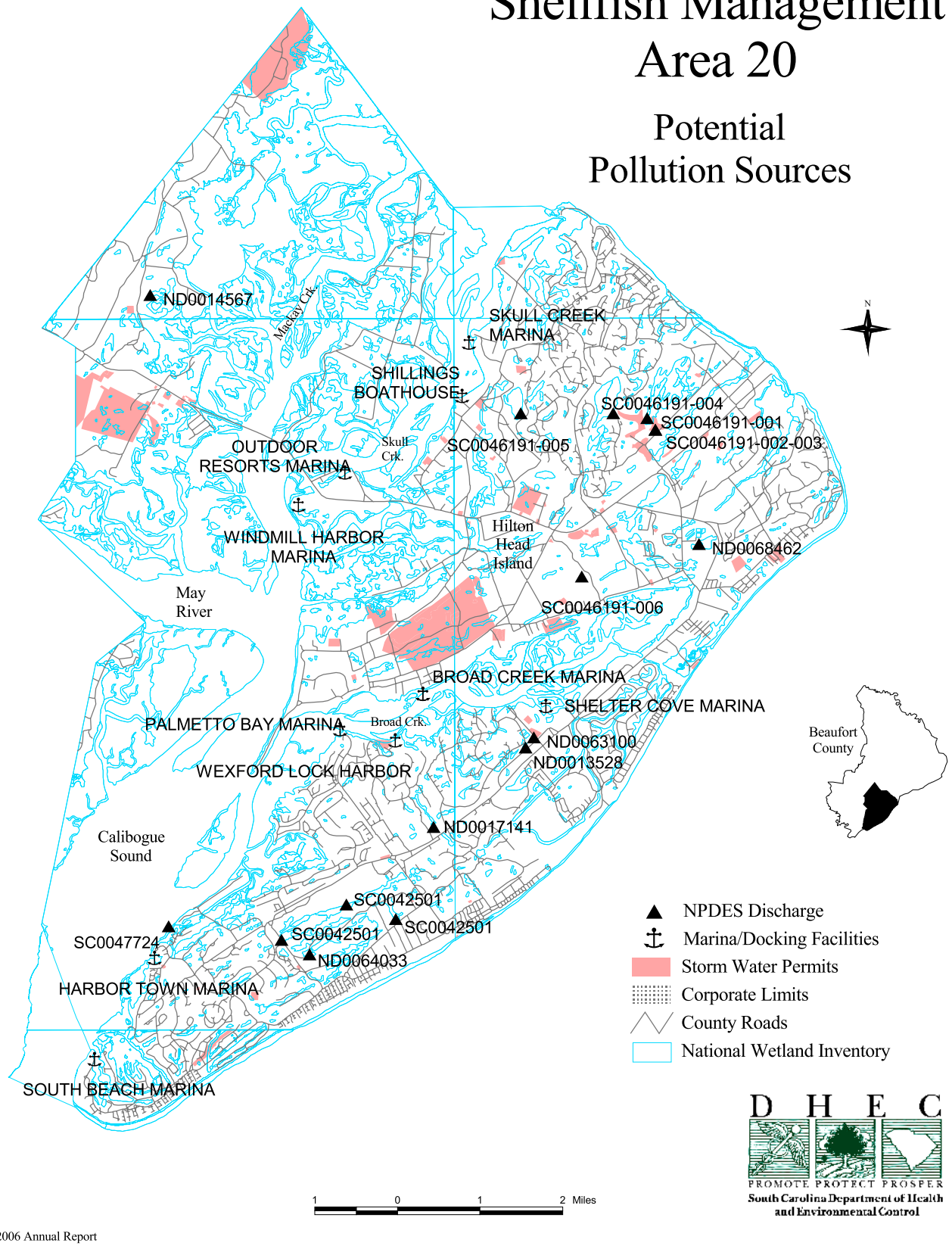

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TABLE #2
Shellfish Management Area 20
FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Shellfish Water Quality Sampling Stations between

January 1, 2003 and December 31, 2005

Station # ▶	1	2	3	4A	5	6	7	9	10	11
SAMPLES	36	36	36	36	36	36	36	36	36	36
GEOMEAN	2.8	2.5	3.8	8.4	2.9	4.7	3.4	2.7	3.6	3.2
90TH%ILE	7	5	13	18	7	17	10	5	11	8
WATER QUALITY	A	A	A	A	A	A	A	A	A	A
CLASSIFICATION	**A**	**A**	**CA**	**CA**	**A**	**A**	**A**	**A**	**P**	**A**

Station # ▶	12	13	15A	16	17B	18	19A	20A	22	23
Samples	35	35	36	35	36	36	36	36	36	36
GeoMean	3.0	3.7	7.4	10.8	6.7	7.8	2.7	3.4	5.2	5.2
90th%ile	8	11	27	69	16	25	5	10	20	20
Water Quality	A	A	A	R	A	A	A	A	A	A
CLASSIFICATION	**A**	**A**	**CA**	**R**	**CA**	**CA**	**A**	**A**	**A**	**A**

Station # ▶	24	25	26	27	28	29				
Samples	36	36	36	36	36	36				
GeoMean	8.7	8.0	3.0	31.6	5.5	4.9				
90th%ile	29	27	7	289	18	15				
Water Quality	A	A	A	R-ND	A	A				
CLASSIFICATION	**CA**	**R**	**P**	**R**	**CA**	**CA**				

A - Approved **CA** - Conditionally Approved **R** - Restricted
RND - Restricted/No Depuration **P** - Prohibited

TABLE #2 (B)
Shellfish Management Area 20

FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Conditional Management Area Stations

COLLECTED WHILE IN OPEN STATUS BETWEEN
January 1, 2003 and December 31, 2005

Station # ▶	03	04A	15A	17B	18	24	25	28	29		
SAMPLES	19	19	19	19	19	19	19	19	19		
GEOMEAN	2.8	7.2	5.1	5.8	6.1	7.3	5.5	4.4	3.0		
90TH %ILE	6	15	16	14	16	21	17	14	8		
WATER QLTY	A	A	A	A	A	A	A	A	A		
CLASSIFICATION	CA	CA	CA	CA	CA	CA	CA	CA	CA		

STATION # ▶											
SAMPLES											
GEOMEAN											
90TH %ILE											
WATER QLTY											
CLASSIFICATION											

STATION # ▶											
SAMPLES											
GEOMEAN											
90TH %ILE											
WATER QLTY											
CLASSIFICATION											

A - Approved **CA** - Conditionally Approved **R** - Restricted
RND - Restricted/No Depuration **P** - Prohibited

TABLE #3

WATER QUALITY
SAMPLING STATIONS DATA

Shellfish Management Area 20

Detailed data for each shellfish monitoring station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained by writing South Carolina's Department of Health and Environmental Control – Freedom of Information Office at the address below.

Freedom of Information
SC Dept. of Health & Envir. Control
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

TABLE #4

RAINFALL DATA

Shellfish Management Area 20

SOURCE:
Broad Creek Public Service District
Wastewater Treatment Plant

AREA 20 ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: Broad Creek Public Service District Waste Water Treatment Plant

2003	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.05	0.00	0.65	0.00	0.03	0.00	0.48	0.03	0.00	0.00	0.01	0.00
2nd	0.00	0.00	0.12	0.00	0.20	0.00	0.06	0.00	0.06	0.01	0.00	0.00
3rd	0.02	0.00	0.03	0.00	0.20	0.31	0.03	0.00	0.00	0.00	0.01	0.00
4th	0.00	0.14	0.52	0.00	0.00	0.26	0.04	0.36	0.22	0.00	0.11	1.17
5th	0.00	0.01	0.01	0.08	0.00	0.00	0.00	**0.15**	0.49	0.01	0.00	0.00
6th	0.00	0.01	0.81	0.00	0.45	0.28	0.00	1.41	2.63	0.00	0.00	0.00
7th	0.00	0.24	1.48	0.64	0.00	0.31	0.00	0.02	0.10	0.05	0.00	0.00
8th	0.00	0.00	0.00	0.99	0.00	0.89	0.00	0.07	0.07	**0.17**	0.08	0.01
9th	0.00	0.07	0.00	0.55	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.01
10th	0.00	0.24	0.02	0.19	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.34
11th	0.00	0.00	**0.00**	0.10	0.53	0.00	0.00	0.02	0.00	0.02	0.01	0.01
12th	0.00	0.00	0.00	0.00	**0.01**	0.00	0.24	0.00	0.01	0.00	0.00	0.00
13th	0.00	0.00	0.31	0.00	0.00	0.04	0.01	0.00	0.00	0.02	0.00	0.03
14th	0.00	0.00	0.28	0.01	0.00	0.39	1.24	0.00	0.00	0.25	0.00	0.64
15th	**0.00**	0.00	0.01	**0.01**	0.02	0.00	0.01	0.00	**0.00**	0.00	0.01	0.01
16th	0.02	0.92	0.01	0.00	0.09	0.27	0.00	0.00	0.00	0.00	0.01	**0.02**
17th	0.01	0.05	0.81	0.00	0.01	**0.11**	**0.49**	0.00	0.00	0.00	0.00	0.01
18th	0.00	0.00	0.06	0.00	0.85	0.00	0.00	0.01	0.00	0.00	0.24	0.00
19th	0.00	0.01	0.34	0.00	0.01	0.08	0.62	0.00	0.00	0.01	**0.04**	0.00
20th	0.00	0.02	0.66	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00
21st	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00
22th	0.28	0.39	0.00	0.00	0.51	0.00	0.05	0.00	0.00	0.00	0.00	0.01
23rd	0.04	0.00	0.00	0.00	0.34	0.00	0.31	0.00	0.51	0.00	0.01	0.01
24th	0.00	0.00	0.00	0.00	0.01	0.00	0.58	0.00	0.01	0.00	0.02	0.01
25th	0.00	**0.00**	0.00	0.53	0.53	0.00	0.30	0.00	0.00	0.05	0.00	0.00
26th	0.00	0.04	0.00	0.01	0.01	0.00	0.95	0.00	0.04	0.00	0.01	0.01
27th	0.00	0.55	0.00	0.00	0.06	0.00	0.13	0.00	0.02	0.19	0.01	0.03
28th	0.00	0.00	0.00	0.00	0.00	0.12	0.01	0.00	0.00	3.58	0.23	0.01
29th	0.00		0.00	0.00	0.00	0.03	0.01	0.00	0.00	0.01	0.00	0.01
30th	0.00		0.26	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31st	0.00		0.00		0.00		0.00	0.03		0.00		0.00

(Monthly Figures) **Year's Rainfall Total: 39.20**

SUM	0.42	2.69	6.38	3.12	3.86	3.09	5.56	2.23	4.31	4.38	0.82	2.34
MAX	0.28	0.92	1.48	0.99	0.85	0.89	1.24	1.41	2.63	3.58	0.24	1.17
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.01	0.10	0.21	0.10	0.12	0.10	0.18	0.07	0.14	0.14	0.03	0.08

"ND"/"--" = no data (Shaded/bold cells indicate the dates shellfish waters were sampled.)

AREA 20 ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: Broad Creek Public Service District Waste Water Treatment Plant

2004	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.01	0.03	0.00	0.00	2.55	0.04	0.14	0.21	0.00	0.00	0.01	0.01
2nd	0.00	**0.16**	0.00	0.00	1.33	0.01	0.03	0.72	0.00	0.43	0.00	0.00
3rd	0.00	0.01	0.00	0.00	0.45	0.04	0.44	0.00	0.00	0.54	0.01	0.00
4th	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.00	0.01	0.11	0.00
5th	0.01	0.01	0.00	0.00	0.00	0.08	0.00	0.00	0.13	0.00	0.00	0.00
6th	0.00	0.63	0.00	**0.00**	0.00	0.37	0.00	0.00	1.15	**0.00**	0.00	0.08
7th	**0.00**	0.01	0.00	0.00	0.00	0.00	0.08	0.00	0.34	0.00	0.00	0.01
8th	0.11	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.21	0.64	0.08	0.00
9th	0.42	0.00	0.05	0.00	0.00	0.12	0.05	0.00	0.00	0.25	0.00	0.00
10th	0.00	0.00	0.00	0.01	0.00	0.00	0.01	**0.00**	0.26	0.02	0.00	0.32
11th	0.00	0.23	0.00	0.01	0.00	0.00	0.38	0.05	0.05	0.00	0.01	0.00
12th	0.00	0.44	0.00	0.61	0.00	0.03	0.00	2.10	0.17	0.07	0.00	0.00
13th	0.00	0.06	0.00	0.54	0.00	0.97	**0.00**	0.52	1.93	0.00	0.00	0.00
14th	0.00	0.82	0.00	0.00	0.00	0.44	0.00	0.27	0.07	0.00	0.00	**0.00**
15th	0.00	0.04	**0.13**	0.00	0.00	0.05	0.00	0.31	0.01	1.39	0.01	0.00
16th	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.05	0.00	0.01	0.00
17th	0.00	0.11	0.00	0.00	**0.00**	0.00	0.02	0.02	0.00	0.00	0.00	0.00
18th	0.06	0.00	0.00	0.00	0.07	0.01	1.30	0.00	0.00	0.00	0.24	0.00
19th	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.04	0.00
20th	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.01	0.00	0.07	0.01	0.00
21st	0.00	0.00	0.00	0.00	0.00	**0.58**	0.00	0.00	0.00	0.00	0.01	0.00
22th	0.00	0.00	0.00	0.00	0.00	1.01	0.00	1.36	0.00	0.00	**0.00**	0.01
23rd	0.00	0.07	0.00	0.00	0.07	0.12	0.00	0.28	0.00	0.00	0.01	0.08
24th	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.02	0.04
25th	0.05	0.21	0.00	0.00	0.00	0.01	0.00	0.03	0.00	0.00	0.00	0.34
26th	0.81	0.43	0.00	0.35	0.00	0.27	0.02	0.00	0.72	0.01	0.01	1.32
27th	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.37	1.19	0.00	0.01	0.01
28th	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**	0.17	0.23	0.00
29th	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.01
30th	0.00		0.01	0.20	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01
31st	0.00		0.00		0.01		1.51	0.02		0.02		0.00
(Monthly Figures)							**Year's Rainfall Total:**				**40.63**	
SUM	1.48	3.27	0.19	2.00	5.11	4.47	4.69	6.34	6.28	3.74	0.82	2.24
MAX	0.81	0.82	0.13	0.61	2.55	1.01	1.51	2.10	1.93	1.39	0.24	1.32
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.05	0.11	0.01	0.07	0.16	0.15	0.15	0.20	0.21	0.12	0.03	0.07

"ND"/"--" = no data (Shaded/bold cells indicate the dates shellfish waters were sampled.)

AREA 20 ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: Broad Creek Public Service District Waste Water Treatment Plant

2005	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	0.00	0.00	**0.00**	0.66	0.02	0.30	0.61	1.00	0.00	0.00	0.00	0.00
2nd	0.00	0.13	0.00	0.88	0.00	0.24	0.17	0.41	0.00	0.11	0.03	0.00
3rd	0.00	0.59	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.07	0.00	0.00
4th	0.00	0.00	0.00	0.00	**0.00**	0.02	0.01	0.00	0.00	0.13	0.01	0.03
5th	0.00	0.00	0.04	**0.00**	2.70	0.02	0.00	0.00	0.06	4.38	0.00	0.36
6th	0.00	0.00	0.01	0.00	0.10	0.00	0.00	0.02	0.86	0.18	0.00	0.00
7th	0.00	0.00	0.00	1.18	0.00	0.00	0.00	0.24	0.00	0.63	**0.01**	0.00
8th	0.01	**0.00**	0.38	0.00	0.00	0.00	0.00	1.10	0.00	0.01	0.01	1.56
9th	0.00	0.15	0.00	0.00	0.00	0.00	0.68	0.00	0.00	0.00	0.01	0.32
10th	0.01	0.00	0.00	0.00	0.00	0.04	0.02	0.15	0.00	1.73	0.00	0.00
11th	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.22	0.00	0.01	0.00	0.00
12th	0.01	0.00	0.00	0.06	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
13th	0.02	0.00	0.00	0.45	0.00	0.00	0.48	0.00	0.00	0.00	0.00	0.00
14th	0.51	0.09	0.64	0.00	0.00	**0.00**	0.01	0.01	0.00	0.01	0.04	0.00
15th	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
16th	0.08	0.01	1.85	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00	0.00
17th	0.00	0.00	0.09	0.00	1.14	0.00	0.00	0.00	0.00	**0.00**	0.00	0.72
18th	0.00	0.00	0.00	0.00	0.24	0.51	0.00	0.20	0.00	0.01	0.00	0.44
19th	0.00	0.00	0.01	0.00	0.00	1.48	**0.00**	0.03	0.00	0.00	0.01	0.00
20th	0.00	0.01	0.00	0.00	1.73	0.00	0.00	0.00	**0.00**	0.00	1.16	**0.00**
21st	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.42	2.44	0.00
22th	0.00	0.00	2.22	0.54	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00
23rd	0.00	0.00	0.02	0.06	0.00	0.00	0.00	1.82	0.00	0.00	0.00	0.01
24th	0.00	0.50	0.00	0.00	0.15	0.00	0.00	0.29	0.00	0.92	0.00	0.02
25th	**0.00**	0.10	1.14	0.00	0.00	1.91	0.00	0.38	0.00	0.00	0.00	0.20
26th	0.00	0.00	0.01	0.02	0.00	0.04	0.00	0.75	0.00	0.00	0.00	0.00
27th	0.00	1.77	3.21	0.05	0.00	0.04	0.00	0.91	0.34	0.00	0.08	0.00
28th	0.00	0.08	0.93	0.00	0.00	0.48	0.00	0.00	0.01	0.00	0.04	0.01
29th	0.45		0.00	0.00	0.00	2.96	0.00	0.00	0.00	0.00	0.01	0.24
30th	0.38		0.00	0.01	0.02	0.00	0.22	0.00	0.00	0.00	0.00	0.00
31st	0.00		0.01		1.62		0.26	0.21		0.01		0.00
(Monthly Figures)							**Year's Rainfall Total:**				**63.69**	
SUM	1.47	3.44	10.57	3.91	7.77	8.45	2.46	7.82	1.27	8.62	3.85	4.06
MAX	0.51	1.77	3.21	1.18	2.70	2.96	0.68	1.82	0.86	4.38	2.44	1.56
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AVG	0.05	0.12	0.34	0.13	0.25	0.28	0.08	0.25	0.04	0.28	0.13	0.13

"ND"/"--" = no data (Shaded/bold cells indicate the dates shellfish waters were sampled.)

Shellfish Management Area 20
A SUMMARY OF RAINFALL
DURING AND PRIOR TO FECAL COLIFORM SAMPLING

Sample Date	Sample Date + 24 hours	Sample Date	Sample Date - 24 hours	Sample Date - 48 hours	Sample Date - 72 hours
01/15/03	0.02	0.00	0.00	0.00	0.00
02/25/03	0.04	0.00	0.00	0.00	0.39
03/11/03	0.00	0.00	0.02	0.00	0.00
04/15/03	0.00	0.01	0.01	0.00	0.00
05/12/03	0.00	0.01	0.53	0.00	0.00
06/17/03	0.00	0.11	0.27	0.00	0.39
07/17/03	0.00	0.49	0.00	0.01	1.24
08/05/03	1.41	0.15	0.36	0.00	0.00
09/15/03	0.00	0.00	0.00	0.00	0.01
10/08/03	0.00	0.17	0.05	0.00	0.01
11/19/03	0.01	0.04	0.24	0.00	0.01
12/16/03	0.01	0.02	0.01	0.64	0.03
01/07/04	0.11	0.00	0.00	0.01	0.00
02/02/04	0.01	0.16	0.03	0.00	0.00
03/15/04	0.00	0.13	0.00	0.00	0.00
04/06/04	0.00	0.00	0.00	0.00	0.00
05/17/04	0.07	0.00	0.63	0.00	0.00
06/21/04	1.01	0.58	0.00	0.00	0.01
07/13/04	0.00	0.00	0.00	0.38	0.01
08/10/04	0.05	0.00	0.00	0.00	0.00
09/28/05	0.00	0.00	1.19	0.72	0.00
10/06/05	0.00	0.00	0.00	0.01	0.54
11/22/05	0.01	0.00	0.01	0.01	0.04
12/14/05	0.00	0.00	0.00	0.00	0.00
01/25/05	0.00	0.70	0.00	0.00	0.00
02/08/05	0.00	0.00	0.00	0.00	0.00
03/01/05	0.00	0.00	1.47	0.07	0.07
04/05/05	0.00	0.00	0.00	0.86	0.00
05/04/05	0.25	0.00	0.00	0.00	0.20
06/14/05	0.00	0.00	0.00	No data	0.20
07/19/05	0.00	0.00	0.00	0.00	0.00
08/16/05	0.00	0.00	0.00	0.00	0.02
09/20/05	0.00	0.00	0.00	0.00	0.00
10/17/05	No data	No data	No data	No data	No data
11/07/05	No data	0.00	0.00	0.00	0.00
11/29/05	No data	No data	0.70	0.11	No data

[Amounts Shown are Per Day, not Cumulative] Rainfall data supplied by Broad Creek PSD

CONDITIONAL
AREAS MANAGEMENT PLAN

Shellfish Management Area 20

Shellfish Management Area 20
BROAD CREEK
CONDITIONAL AREA MANAGEMENT PLAN

JULY 2006

I. AREA DESCRIPTION

The 2006 Annual Update includes the following written description of Broad Creek's Conditionally Approved area, in addition to a prior and a current classification map defining the Conditionally Approved area boundaries:

Broad Creek, from Station 03 to Station 25 (excluding all administratively Prohibited closure zones.

The Broad Creek area was first classified as Conditionally Approved in the 1998 Annual Update. Portions of the Conditionally Approved area are leased by SCDNR to individuals (commercial leases) as Culture Permits C-027, C-028, and C-031. The remainder of the Conditionally Approved area is open to the public for recreational harvesting.

Stations 03 and 15A were added to the Broad Creek Conditionally Approved area in the 2001 Annual Update, which extended the boundary to the mouth of Broad Creek at Calibogue Sound. Station 25 was classified for the first time in the 2002 Annual Update, and that portion of Broad Creek between Stations 24 and 25 was added to the Conditional Management area.

In the 2003 Annual Update, Station 15, at the confluence of Broad Creek and Lawton Creek was de-activated. The station was located within the Prohibited closure zone for the South Island WWTP discharge from the Forest Preserve wetland.

Stations 03, 15A, 04A, 17B, 18, 24, 25, 28, and 29 make up the Broad Creek Conditionally Management Area. Stations 28 and 29 were added to the management area in 2003 and used for classification for the first time in the 2006 Annual Update. **Stations 03, 15A, 04A, 17B, 18, 24, 25, 28, and 29 meet the criteria for an Approved classification in the 2006 Annual Update**.

Six samples were collected in the Conditional Area Open (CAO) status from the Broad Creek Conditional Management Area during CY2005. Nineteen CAO samples were collected at each station during the period January 1, 2003 through December 31, 2005. **Analysis of CAO data indicates all stations in the Conditional Management Area meet the statistical criteria for the Approved classification.**

Historically, the classification of stations 15A, 04A, and 17B have alternated between Restricted and Approved. Special sampling studies and analysis of routine shellfish sampling data indicates that water quality in the Broad Creek Conditionally Approved area is impacted by rainfall and stormwater discharges.

There are no mariculture operations in the area; therefore year round harvesting does not occur.

II. FACTORS INDICATING SUITABILITY OF BROAD CREEK AS A CONDITIONALLY APPROVED AREA

A. The major pollution source adversely affecting water quality in Broad Creek is nonpoint source in origin.

B. Broad Creek receives no substantial freshwater input other than from rainfall and associated runoff.

C. Broad Creek has a tidal range sufficient to allow sufficient exchange with coastal ocean waters. This exchange results in a typical salinity range of 24 ppt to 30 ppt. Depressed salinities due to rainfall are temporary.

D. Broad Creek is relatively small geographically and does not present major patrol difficulties.

III. PREDICTABLE POLLUTION EVENTS THAT CAUSE CLOSURE

Meteorological Events

1. The Broad Creek Conditionally Approved area will be closed upon receipt of 1.40 inches or more of rainfall in a 24-hour period as measured by the Broad Creek PSD wastewater treatment plant personnel.

2. Analysis of data excluding samples taken following rainfall events of 1.40 inches or more in a 24-hour period collected during the shellfish harvesting season (September through May), indicates that Stations 03, 15A, 04A, 17B, 18, 24, and 25, will meet the statistical criteria for an Approved classification. This supports management of this area based upon rainfall of 1.40 inches or more in a 24-hour period.

3. A review of rainfall data for the past five years (2001 to 2005) indicates that the area will receive an average of 3.4 rainfall events per year during shellfish harvesting season equal to or greater than 1.40 inches. Although some events are likely to crossover, each event is considered to be separated from the subsequent event by a minimum duration of 14 days. With this in mind, one could expect the Conditionally Approved area in Broad Creek to remain in an open status during 80% (193 days) of the harvest season (September 16 through May 15; a total of 242 days).

   Number of 24- hour Rainfall events > or = 1.40 inches Sept. 16 to May 15

2001	1
2002	2
2003	2

2004	3	
2005	9	
Total	17 / 5 = 3.4 / yr	3.4 x 14 day closure = 47.6 days closed

(47.6 / 242 days in harvest season = 20 % closed, 80% open)

4. Any significant input from migratory waterfowl populations is offset by tidal flushing.

IV. IMPLEMENTATION OF A CONDITIONAL AREA CLOSURE

The Low Country EQC Regional Shellfish program manager is the responsible party for determining compliance with all aspects of this plan, including the tracking of rainfall criteria violations. In the event that the manager shall be unavailable, a responsible employee shall be designated responsibility for tracking, compliance, and notification procedures.

A. **Implementation of Closure (September through May):** The following procedures shall be used in the event a closure is necessary:

1. The State Shellfish Sanitation Program Manager (or his designee) shall be notified upon determination of the need for any closure. Media notification shall be coordinated through the Shellfish Sanitation Program and the Office of Media Relations.

2. The Office of Media Relations (Media Relations) is the responsible authority for issuance of news releases. Media Relations shall be notified within four hours of the determination of the need for a closure. They shall be provided with specific information regarding the pollution event and affected area.

3 Within four hours of a determination of the need for a closure, Regional Shellfish staff shall notify the South Carolina Department of Natural Resources (SCDNR), Office of Commercial Fisheries Management, and SCDNR Law Enforcement, by telephone and/or fax.

4. Regional Shellfish Sanitation Program staff shall notify certified Shellfish Shippers with interests in the affected area. SCDNR is the State agency having authority for the issuance of individual commercial shellfish harvest permits and should provide notification to individual permittees.

5. Prior to September 16, SCDHEC shall post an adequate number of "Warning Conditional Area" signs throughout the area. Additionally, maps indicating the current condition of the affected area will be posted at locations adjacent to the area suitable for public information display. Map postings shall take place immediately following issuance of the draft news release.

6. During the closure period, Regional Shellfish Sanitation Program officers shall insure patrols are conducted at a frequency sufficient to deter illegal harvest activities. Schedules shall include night and weekend patrols. Documentation of these patrols shall be maintained.

B. Management of Conditional Areas Extraneous to the Normal Shellfish Harvest Season

The Broad Creek Conditionally Approved area shall remain in the closed status from May 15 through September 15 unless the shellfish season is modified by the South Carolina Department of Natural Resources.

C. Enforcement of Closures

1. DHEC is the agency responsible for public health protection. This includes public notice and closures of shellfish management areas.

2. Regional Shellfish Sanitation Program officers shall insure that the area is patrolled at a frequency adequate to prevent illegal harvesting. Documentation of these patrols shall be maintained. Regional Shellfish Sanitation Program officers may coordinate with other law enforcement officers to insure adequate area coverage

V. CONTROL ELEMENTS USED TO REOPEN AFTER A POLLUTION EVENT

Opening of areas following closure due to violation of management plan criteria shall adhere to the following control elements.

A. The area shall remain closed for a minimum period of 14 consecutive days following the end of a rainfall event. If, during the initial closure period, a subsequent event occurs that meets the criteria for a closure, the area shall remain closed for 14 consecutive days following the occurrence of the subsequent event.

B. The bacteriological water quality at all stations located within, or on the boundary of, the closed Conditionally Approved area shall be assessed prior to reopening. For the 2006-2007 shellfish season this shall include Stations 03, 15A, 04A, 17B, 18, 24, 25, 28, and 29. The area shall remain closed and be re-sampled at a later date if more than 15% of the reopening samples exceed a fecal coliform MPN of 43.

C. Regional Shellfish Sanitation Program staff and the State Shellfish Sanitation Program Manager (or his designee) shall concur on the decision to reopen the area.

D. Regional Shellfish Sanitation Program staff shall notify SCDNR, Division of Commercial Fisheries Management, of the opening following issuance of the news release. Closures shall be coordinated with SCDNR Law Enforcement at the regional level

E. Local Certified Shellfish Shippers shall be notified by SCDHEC of the opening as soon as possible.

F. Map postings shall be updated to reflect the open status.

VI. MANAGEMENT PLAN EVALUATION

This plan shall be evaluated once per year and included as a part of the Shellfish Management Area 20 Annual Update.

Shellfish Management Area 20
BROAD CREEK
EVALUATION OF CONDITIONAL AREA MANAGEMENT PLAN

JULY 2006

1. BACKGROUND INFORMATION

The following is a description of the Area 20 Conditionally Approved areas as indicated in the July 2005 Annual Update:

> *Broad Creek, from Station 03 to Station 25 (excluding all administratively Prohibited closure zones.*

A map indicating the Area 20 Conditionally Approved area boundaries is included in the 2006 Annual Report.

The evaluation period is CY 2005. Closure of the Conditionally Approved area was based on rainfall of 1.40" or greater in a 24-hour period. Rainfall is measured at the Broad Creek PSD WWTP.

There is no mariculture activity within this area therefore year-round harvesting is not allowed.

For the period January 1, 2003 through December 31, 2005, water quality at all stations within or on a boundary of the Broad Creek Conditional Management Area met criteria for an Approved classification.

2. REEVALUATION OF CONDITIONAL CLASSIFICATION

During the shellfish harvest season, there were nine rainfall events greater than or equal to 1.40":

Date	Event	Sample Date	Reopening Date
02/27/05	Area did not Close- Rainfall (1.77”)	--	--
03/16/05	Area Closed - Rainfall (1.85”)	04/05/05	04/11/05
03/22/05	Area Remained Closed- Rainfall (2.22”)	04/05/05	04/11/05
03/27/05	Area Remained Closed- Rainfall (3.21”)	04/05/05	04/11/05
05/05/05	Closed Area- Rainfall (2.70”)	*N/A	09/16/05
10/05/05	Closed Area- Rainfall (4.38”)	10/17/05	10/25/05
10/10/05	Area Remained Closed- Rainfall (1.73”)	10/17/05	10/25/05
11/21/05	Closed Area- Rainfall (2.44”)	11/29/05	12/06/05
12/08/05	Closed Area- Rainfall (1.56”)	12/09/05	12/21/05

*Note: No Special samples were taken, closed due to end of Shellfish Harvesting Season on May 14th 2005.

3. COMPLIANCE WITH MANAGEMENT PLAN

For the CY2005 evaluation period, the Broad Creek Conditional Management area was managed in accordance with the plan at all times, with one exception. Although the area met Approved area criteria for the three-year review period ending December 31, 2005, the area was not closed on February 27, 2005 as required by the management plan. Six samples were collected in the Conditional Area Open (CAO) status from the Broad Creek Conditional Management Area during CY2005. Nineteen CAO samples were collected at each station during the period January 1, 2003 through December 31, 2005. Analysis of CAO data indicates all stations in the Conditional Management Area meet the statistical criteria for the Approved classification.

COOPERATION OF PERSONS INVOLVED

Cooperation by Broad Creek WWTP personnel in reporting rainfall events exceeding management plan criteria was prompt. WWTP personnel readily supply necessary rainfall data upon request.

5. EVALUATION OF WATER QUALITY WITH RESPECT TO THE BACTERIOLOGICAL STANDARDS FOR ITS CLASSIFICATION

For the Annual Update three-year review period (January 1, 2003 through December 31, 2005) for Shellfish Management Area 20, water quality at Stations 03, 15A, 04A, 17B, 18, 24, and 25 in Broad Creek met the statistical criteria for an Approved classification (Table 2(A), Area 20 Annual Update). However, due to potential water quality variability along with the knowledge that stormwater runoff can have an adverse impact on water quality and public health, these stations have been classified as Conditionally Approved.

For the three-year Annual Update review period, analysis of samples collected at stations 03, 15A, 04A, 17B, 18, 24, and 25 in the Broad Creek Conditional Area while in the Conditional Area Open status (CAO), indicates these stations meet the statistical criteria for Approved classification.

FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Conditional Management Area Stations
collected while in Conditional Area Open (CAO) status between
► January 1, 2003 and December 31, 2005 ◄

Station #	03	04A	15A	17B	18	24	25	28	28
SAMPLES	19	19	19	19	19	19	19	19	19
GEOMEAN	2.8	7.2	5.1	5.8	6.1	7.3	5.5	4.4	3.0
90TH %ILE	6	15	16	14	16	21	17	14	8

Station #	03	04A	15A	17B	18	24	25	28	28
WATER QLTY	A	A	A	A	A	A	A	A	A
CLASSIFICATION	CA	CA	CA	CA	CA	CA	CA	CA	CA

6. RECOMMENDATIONS

The rainfall amount should remain at 1.40" in a 24-hour period and be re-evaluated for the area on an annual basis. Stations 28 and 29 should be included in the list of stations to be sampled following Conditional Area rainfall closures.

TABLE #5

Special Data Analyses
Conditional Areas Management Plan

Shellfish Management Area 20